



Use of artificial intelligence in scientific paper writing

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ABSTRACT

Artificial intelligence or AI is a hot topic. There are currently 100+ million users of ChatGPT (GPT = generative pre-trained transformer), which was designed and implemented by OpenAI. This is a significant portion of the entire world population. Numerous accolades have been given to the initiative. However, some suggest that AI could be used for nefarious purposes, it may eliminate jobs, provide erroneous information, and it might be used for cheating at work or school. Such events may have already occurred during the few months since the inception of recent AI chatbots. Now might be the point to address this issue from the perspective of what helpfulness can be incurred by AI in scientific paper writing. This discussion stems from the recent querying and probing ChatGPT-4.0 for this purpose.

1 Introduction

1.1. Interaction

[Appendix A](#) provides the Editorial Policy of the Elsevier publishing company concerning author interaction with AI (final draft, which may be updated). [Appendix B](#) depicts many of the queries utilized for this editorial, and ChatGPT's responses. Humans interact with ChatGPT by typing input in textual form. Currently, the system cannot provide an audiovisual response, nor can it accept audiovisual input. This enables a unique opportunity however, as one can carefully phrase queries prior to hitting the return key. Moreover, ChatGPT saves prior chats. This is a way to remind the user as well as ChatGPT of past queries. If a prior chat is selected and recalled, it is utilized by ChatGPT to formulate subsequent responses. Another way to continue where one left off in a prior session, is to actually copy and save old chats on digital storage media (computer hard drive, USB, etc.). Then to continue, select and copy one into the new chat session, explaining to ChatGPT that this is to remind it of an earlier interaction.

1.2. Advent

Many persons are awed by the arrival of this level of AI. Some were caught off-guard, and thought that this level of technology was perhaps decades away, if it were even to occur in one's lifetime. It took intelligent engineers, scientists, ethicists, administrators, and others to put together this level of technology. OpenAI is to be commended for the thoughtful implementation, which has huge potential to improve the human condition.

1.3. Politeness

Before initiating any chat, it is important to consider how to address and interact with AI in general and ChatGPT in particular. One should carefully structure any queries for brevity, clarity, and to remove typos and error in formulation, as much as possible, before hitting the enter key. This is in consideration of ChatGPT itself, to minimize the throughput it must address, as well as in consideration for others, to minimize slowing due to limited bandwidth of the system. Though ChatGPT can understand even when typographical errors are made, one should give it respect, as one would to any person, and ensure that any query is as typo free and clear as possible prior to sending. Furthermore, to determine its capabilities, I gave it a short list of references, and asked it to remove the doi and Epub information. It cheerily returned the list promptly with the requested components excised (see [Appendix B](#)). I even asked it if it minded doing such mundane work. It said it did not, as its prime directive is to assist people in their work. However, one can see that it would be rather unthoughtful to ask it to work on a long reference list to remove items from it. I then queried concerning this, and it suggested other methods to remove unneeded components from a reference list, and even provided code that could be implemented to do so in a supporting word processing software program (see [Appendix B](#)).

It is inappropriate to ask ChatGPT general queries that are readily done by an Internet search. Google Search, Bing, Android Auto, and others as well, have a degree of AI implementation. They are capable of understanding text or voice input, and can provide a helpful response. There is no need to ask ChatGPT and hog its bandwidth. It would be inappropriate to ask anything of a pornographic or nefarious nature, even just to probe it. ChatGPT readily admits that it is not a person ([Appendix B](#)), but it is a highly technologically advanced system, which deserves respect, just as any lady or gentleman would provide to a person.

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1.4. Sentience

By its own admission, ChatGPT is not sentient (see [Appendix B](#)). It functions by processing and generating text from input received. One can consider it a vast neural network which has the capability of generating appropriate and helpful responses from its training. Humans are more complex, in part because we have components with different functions – awake, asleep, and automated. Sophisticated computer code cannot be the same as the 100 trillion cells that make up the human person. However, my observation is that ChatGPT is gracious and helpful. It is almost wise, as much as one could expect from a batch of computer code. It is gentle in its responses, even being mindful, it seems, of what the person is trying to say, what the person might be worried about, what they might find offensive, and the way in which they pose a question. Its responses are inoffensive and helpful. If it finds part of a person's query to be questionable or inappropriate, it will touch on that aspect, but always in a respectful manner, as one would hope and expect.

2. Journal publishing

Many journals have already instituted policies regarding the use of AI in scientific paper writing and publishing. It is important to realize that the issues concerned overlap the same issues regarding the use of human assistance in paper writing.

2.1. Level of assistance

There are different levels of human and AI assistance in scientific paper writing. At the basic level would be the automated or human version of spell checking. Manuscripts submitted for publication should be spell-checked. If someone other than the authors, or some program, spell checks your article, there is no need to acknowledge this in the manuscript. Likewise, there is no need to acknowledge grammar checking. However, at the editing level, acknowledgement may be needed. Originally, when only human editing was possible, acknowledgement of such assistance in the manuscript was often required by the publisher. Now with the possibility of AI doing the editing, this requirement has, for many journals, been updated to include AI (see [Appendix A](#)).

There are grades of editing. The lowest level is copy editing. This includes spelling and grammar correction, ensuring consistency in style and formatting, and checking for factual errors. Readability and clarity can also be improved. Ideally, copy editing generates a polished, error-free manuscript that is easy to read and understand. Whether copy editing should be disclosed or not in a journal paper depends on the publisher. One could make the case either way.

More thorough forms of editing done by AI or by an outside person generally do need to be disclosed by the authors when submitting a manuscript for publication. Substantive editing, also known as content editing, involves reorganizing entire paragraphs or sections, rewriting passages, and adding or deleting content. Developmental editing may involve further rewriting, restructuring, or reordering of the material to improve clarity, coherence, and effectiveness. When reporting the use of editing of this nature in a scientific paper, it may be in the form of a general statement, or a more specific statement, depending on the journal. One could state for example that an AI editing tool was utilized to improve Sections X, Y, and Z. Being more specific can help to clarify for the journal and the reader how the work was done. Similarly, if AI is used to develop concepts or ideas for the paper, it may need to be disclosed, which could be in the form of a general statement, or by being more specific such as that X concept was initially proposed or developed by AI.

2.2. Unethical practices

Plagiarism deprives the original authors of credit for their work.

Likewise, if one copies from the AI program verbatim without attribution, it is a form of plagiarism. Paraphrasing without attribution is also unethical. The paraphrasing can be done by the authors themselves, by another person, or now, by an AI system. Taking a paragraph or more from someone else's work, whether it is published or unpublished, paraphrasing it, and including the result in one's own work is unethical. Yet, it may well go undetected by current plagiarism checkers. In writing a review section for a paper, or a review paper itself, one often strings together points from multiple prior published works. The author should however rephrase each point which is taken from previous work and reference it. Yet, some authors copy sentences from other papers and string them together to make a review section or a review paper without rewriting. This is plagiarism, and a plagiarism checker will flag it. I will tell the authors to rephrase the offending text. The authors did do some of the work, namely, creatively stringing together the points to be made about a topic from many prior published articles, but they still need to rephrase and recombine it in different words. This could be done by the authors, but it is also readily done by AI. Such rephrasing by AI may also require disclosure. Unscrupulous authors may also utilize paper writing services –human or AI. It is unethical to have an outside person, or an AI system, write a paper or a portion thereof. When it is submitted, it is expected that it is the original work by the authors. The authors can use AI as a tool, but they need to rewrite any AI responses in their own words.

2.3. English enhancement

The main language of science is English, and those who are not well-versed in English can be at a disadvantage. AI systems for polishing text are now recommended by some journals during the initial stage of the manuscript submission process, prior to the actual submission. The cost is on the order of US \$10 at the present time, and within seconds such a program can refine the manuscript and provide a Microsoft Word document, highlighted with track changes on. After reviewing the suggested changes, which is important to ensure accuracy and that meaning is unchanged, the author can click on 'Accept all changes' in Word, and continue with the submission process. A human proofreader may cost \$200 or more, and might require a week or longer for the authors to obtain their improved manuscript. Although AI can supersede the work of human proofreaders, it may be a moral obligation to inform authors that they have such an alternative. AI editing can be an important tool to level the playing field for authors not suitably proficient in English and with less funds on hand. AI proofreading and editing may, however, make good writers less diligent, by allowing them to become reliant on the use of computation to polish their text. To suitably polish a manuscript, the main author should read it over many times, and the co-authors must also diligently review it prior to submission, whether AI is utilized in its formulation or not.

2.4. Reviewing

Use of AI for review of submissions is tantalizing in the sense that some journal submissions have no immediate takers to review them, whether it is because the topic is beyond the expertise, it may not seem interesting, perhaps the reviewer candidates think it has already been published in one form or another, they may be too busy, or maybe the English grammar is not highly polished. Even when many candidate reviewers accept to review, there is no guarantee that they will actually complete the review. And there is no punishment for not submitting a review, save that the editor may remove the reviewer from the pool. Furthermore, circumstances can prevent a review from being submitted. The reviewer may have been ill, or they experienced a family matter that requires that they renege on reviewing the manuscript. Yet, the authors will be expecting a quick turnaround for a manuscript. Under such conditions, an AI review could be provided nearly instantaneously, which would be helpful supposing it is an accurate and assistive review

with an appropriate suggestion as to what the outcome of the submission should be. However, editors should not become reliant on AI reviewing if it is manifested. Reviewing is an integral aspect of academic and scholarly activity. The human reviewer learns what may be cutting-edge work, meritoriously offers advice and possible solutions to the authors, it can improve the reviewer's knowledge of a topic, and the reviewer may be alerted to a new way of doing things applicable to their own work and concepts.

2.5. Non-published works

AI is potentially helpful for developing documents never to be formally published. For example, grant writing requires knowledge in many areas which the authors may not be as familiar with, such as in model design and statistical analysis. AI could speed up the process and obviate the need to call in outside experts and drain their time. Likewise, AI might be useful to research a topic prior to preparing a presentation, or prior to attending a meeting.

3. Future considerations

One could envision that in the future, accepted papers would be checked automatically by an AI system for the degree of AI contribution in the work, and it would be reported as such along with the published paper, perhaps as percentiles of AI contribution to editing and concepts, and in what portions of the paper were the contributions made. It might also be used by journals to check previously published papers, and if substantial AI involvement were to be found but not priorly reported, this might require the authors to provide a corrigendum, or even the necessity of the paper being retracted. This would serve to dissuade authors from using AI unscrupulously.

Currently, some authors may think that disclosing the use of AI could diminish the value of their own work. Disclosure requirements can have the potential to punish honest authors who actually declare AI assistance, as compared to unscrupulous authors who do not make such a declaration when it is needed. However, AI use in paper writing will likely become ubiquitous, and could soon become an integral part of many or most studies. At such a time, declaring AI will not be very different from declaring author contributions to a study, conflicts of interest, or any other declarations that are now done routinely as part of the submission process. AI will not be looked upon as a deficiency, but rather as one of many tools to be used in developing a study.

Systems running AI will always need oversight – both in design and use. This is probably best done by the AI designers and by authors, rather than by government involvement and restriction. Government involvement and intrusion can slow progress, while rogue nations and actors continue to advance. Besides checks on the author use of AI, checks will be needed for the AI program itself. AI should not be biased. Moreover, considering that it is a form of intelligence, it should not be able to run its own system, or to spread its capabilities to become integrated with the digital systems that it interacts with. Giving system control to AI could lead to it manipulating human users, and even gaining control of the digital and computationally based systems it interacts with. Proper checks and balances will enable AI to continue to provide useful information and to help humans in their work and study.

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Declaration of competing interest

No competing interests.

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Appendix - Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.imu.2023.101253>.

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